



Back Home Again in Indiana

Risk MAP

# INTEGRATING DFIRM FLOOD DEPTH GRIDS WITH HAZUS-MH TO ESTIMATE LOSS AND COMMUNICATE RISK

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# Presentation Outline

- The Risk MAP era begins...
- Pilot study using DFIRM depth grid in a “Level 1.5” HAZUS analysis to estimate loss
- Compare loss estimates between HAZUS-generated H&H and DFIRM depth grid
- Techniques and tools for communicating risk to a wide audience to aid in **reducing loss of life and property**



# What is Risk MAP?

- Mapping, Assessment, Planning
- **VISION:** Deliver quality data that increases public awareness and leads to actions that **reduces loss of life and property**
- An **integrated approach** to identifying flood hazards and merging flood risk assessments into hazard mitigation plans (**Information Redistribution**)



# Risk MAP Goals

1. Address gaps in flood hazard data for actuarial soundness of the NFIP
2. Increase flood-risk awareness that results in a reduction of vulnerability to flooding
3. Engage in risk-based mitigation planning to **reduce loss of life and property**
4. Provide a digital platform that improves resource management and data sharing
5. Develop synergies to enhance decision-making through effective risk communication



# Risk MAP Lifecycle



Graphic courtesy of FEMA



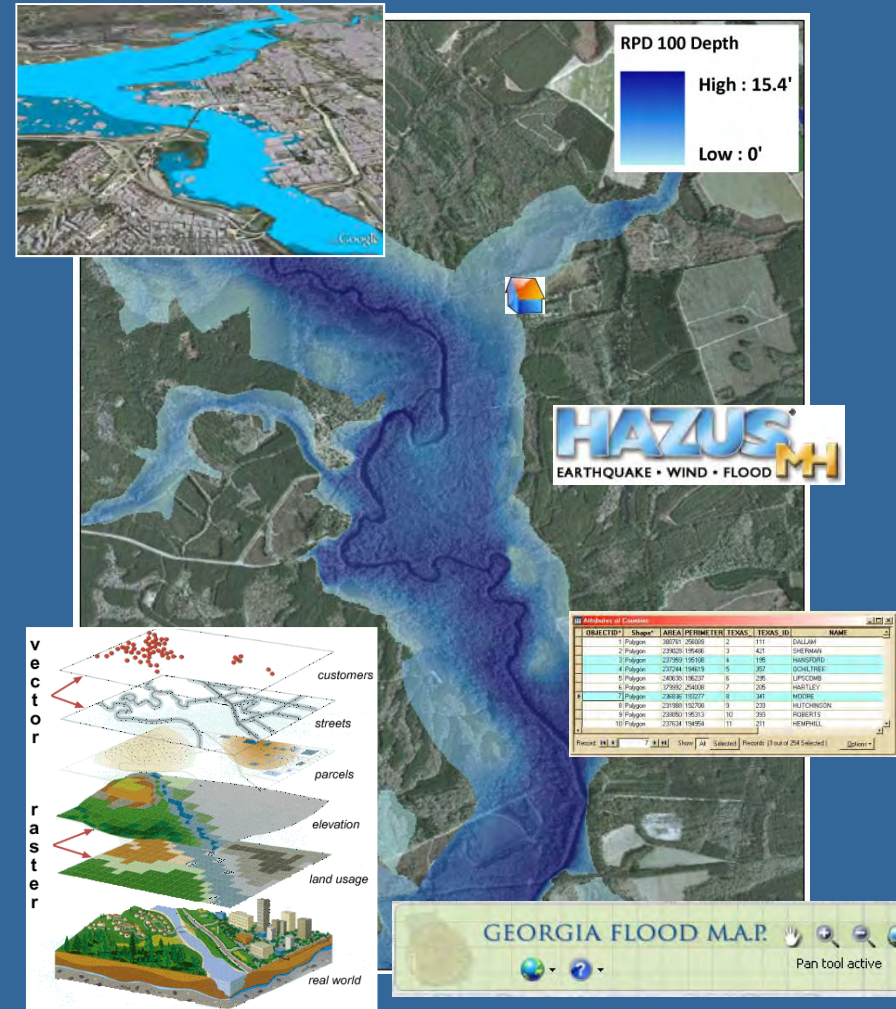


# Map Mod → Risk MAP

## Map Mod Maps



## Risk MAP Tools



# Bulloch County Flood Risk Study



ENVIRONMENTAL PROTECTION DIVISION  
GEORGIA DEPARTMENT OF NATURAL RESOURCES

## Bulloch County HAZUS-MH Preliminary Flood Study



DRAFT AUGUST 2009





# Bulloch County Flood Risk Study

## STUDY GOALS

1. **Identify** flood risk to communities
2. **Communicate** flood risk to stakeholders
3. **Realize** a Map Mod → Risk MAP project  
(take DFIRM data into the real world)



# Bulloch County Flood Risk Study

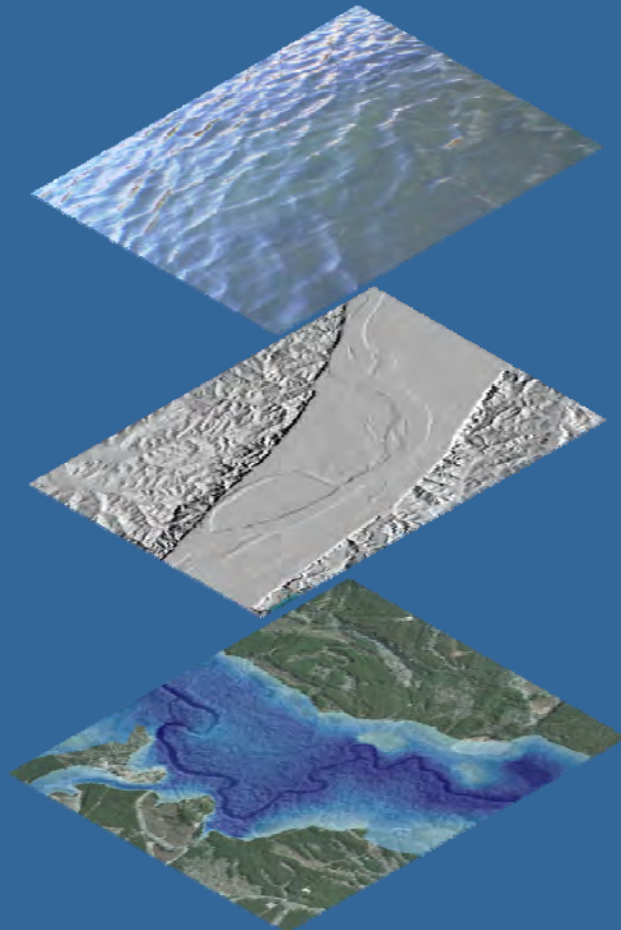


# DFIRM Engineering Parameters

- FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners*
- Hydrology
  - Boundaries interpolated between surveyed cross sections at scale of 1:400 with a 2-foot contour interval
- Hydraulics
  - 100-year return period



# Flood Depth Grids



Water  
Surface

-

Ground  
Surface

=

Flood  
Depth

# Using DFIRM in HAZUS

- Processed DFIRM data (cross sections with WSEL + SFHA boundary) in ArcMap 3D Analyst to create depth raster
- All HAZUS needs is this depth raster
- Not necessary to run hydrology in HAZUS
- Hydraulics step to process depth grid took **1 minute 26 seconds**





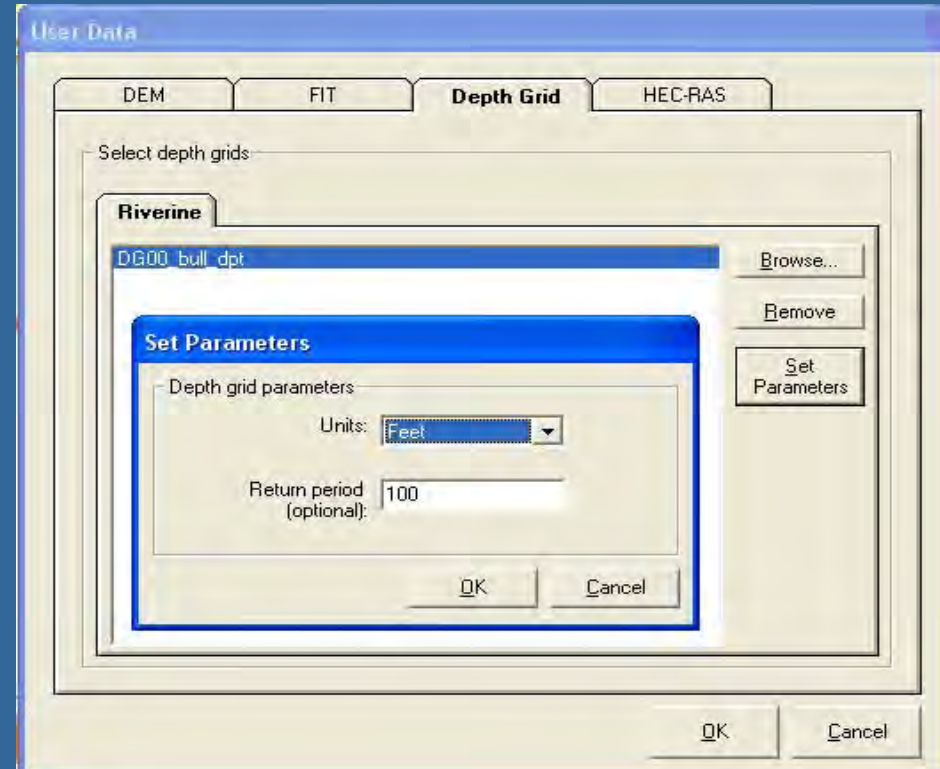
# HAZUS Flood Model

- Hydrology
  - 10-meter NED DEM
  - 2 sq. mile drainage area
- Hydraulics
  - 100-year return period
- Total Time
  - **32 hours** ('create study region' through 'run analysis')



# UD Depth Grids in HAZUS

1. 'User Data'; set parameters
2. Create Scenario
3. Run Hydraulics
4. Run Analysis
5. Extract Results



# Utilizing a UD Depth Grid

- When data is available
- When project calls for enhanced data
- Compare HAZUS H&H with engineering data from other methods in a 'Level 1.5' analysis (no local building or damage function used)
- Align with Risk MAP goals



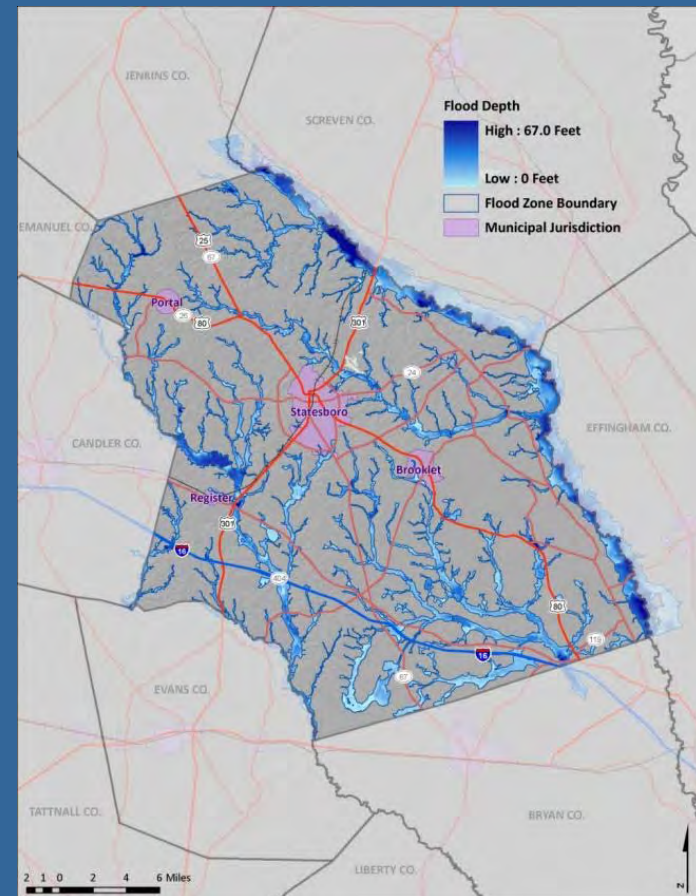
# HAZUS Flood Risk Assessment

- What results did we want to extract from HAZUS to **identify and communicate risk** for a 1-percent annual chance flood using recently developed DFIRM data?
  - Direct physical damages to GBS
  - Direct economic losses by occupancy type
  - Agricultural crop losses
  - Social vulnerability



# Results: Total Flooded Area

- Bulloch County is 682 sq. miles
- DFIRM: **104 sq. miles** flooded
  - 15% of county
- HAZUS: **117 sq. miles** flooded
  - 17% of county



COUNTY MAP WITH FLOOD ZONE DELINEATIONS





# Results: GBS Damages

DAMAGED BUILDING COUNTS BY OCCUPANCY TYPE (DFIRM)								
Occupancy Type	Total in County	Number of Buildings in Each Damage Percentage Range						Total Damaged Per Type
		1 to 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%	51 to 100% (Substantial Damage)	
Residential (Pre-FIRM)	20,752	0	6	56	9	27	90	188
Residential (Post-FIRM)		0	3	25	2	11	53	94
Commercial	1,402	0	2	0	0	0	0	2
Industrial	402	0	0	0	0	0	0	0
Agricultural	179	0	0	0	0	0	0	0
<b>TOTAL BUILDINGS</b>	<b>22,735</b>	<b>0</b>	<b>11</b>	<b>81</b>	<b>11</b>	<b>38</b>	<b>143</b>	<b>284</b>

DAMAGED BUILDING COUNTS BY OCCUPANCY TYPE (HAZUS)								
Occupancy Type	Total in County	Number of Buildings in Each Damage Percentage Range						Total Damaged Per Type
		1 to 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%	51 to 100% (Substantial Damage)	
Residential (Pre-FIRM)	20,752	0	8	61	1	1	37	108
Residential (Post-FIRM)		0	5	30	0	1	15	51
Commercial	1,402	0	2	0	0	0	0	2
Industrial	402	0	0	0	0	0	0	0
Agricultural	179	0	0	0	0	0	0	0
<b>TOTAL BUILDINGS</b>	<b>22,735</b>	<b>0</b>	<b>15</b>	<b>91</b>	<b>1</b>	<b>2</b>	<b>52</b>	<b>161</b>



# Results: Direct Economic Losses

**TABLE 5. DIRECT ECONOMIC IMPACTS (DFIRM)**

Occupancy Type	Building Damage
Residential	\$27,720,000
Commercial	\$2,550,000
Industrial	\$1,560,000
Agricultural/Other	\$530,000
<b>TOTAL FOR ALL OCCUPANCY TYPES</b>	<b>\$32,360,000</b>

**TABLE 5. DIRECT ECONOMIC IMPACTS (HAZUS)**

Occupancy Type	Building Damage
Residential	\$16,454,000
Commercial	\$2,471,000
Industrial	\$1,164,000
Agricultural/Other	\$136,000
<b>TOTAL FOR ALL OCCUPANCY TYPES</b>	<b>\$20,225,000</b>



# Results: EF Damages

EXPECTED DAMAGE TO ESSENTIAL FACILITIES (DFIRM & HAZUS)				
Type of Facility	Total Number	Number of Facilities in Each Damage Classification		
		At Least Moderate	At Least Substantial	Loss of Use (In Number of Days)
EOC	0	0	0	0
Fire Station	4	0	0	0
Medical Care Facility	2	0	0	0
Police Station	9	0	0	0
School	21	0	0	0
<b>TOTAL FACILITIES</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>0</b>



# Results: Agricultural Losses

DIRECT ECONOMIC LOSS FOR AGRICULTURE PRODUCTS (DFIRM)				
Type of Crop	Cumulative Dollar Value of Losses Based on Flood Duration			
	Crop Loss with < 1 Day of Inundation	Crop Loss with 3 Days of Inundation	Crop Loss with 7 Days of Inundation	Crop Loss with 14 Days of Inundation
Corn	\$0	\$509,000	\$678,000	\$678,000
Soybeans	\$0	\$20,000	\$27,000	\$27,000
<b>TOTAL FOR ALL CROP TYPES</b>	<b>\$0</b>	<b>\$529,000</b>	<b>\$705,000</b>	<b>\$705,000</b>

DIRECT ECONOMIC LOSS FOR AGRICULTURE PRODUCTS (HAZUS)				
Type of Crop	Cumulative Dollar Value of Losses Based on Flood Duration			
	Crop Loss with < 1 Day of Inundation	Crop Loss with 3 Days of Inundation	Crop Loss with 7 Days of Inundation	Crop Loss with 14 Days of Inundation
Corn	\$0	\$293,000	\$391,000	\$391,000
Soybeans	\$0	\$12,000	\$15,000	\$15,000
<b>TOTAL FOR ALL CROP TYPES</b>	<b>\$0</b>	<b>\$305,000</b>	<b>\$406,000</b>	<b>\$406,000</b>



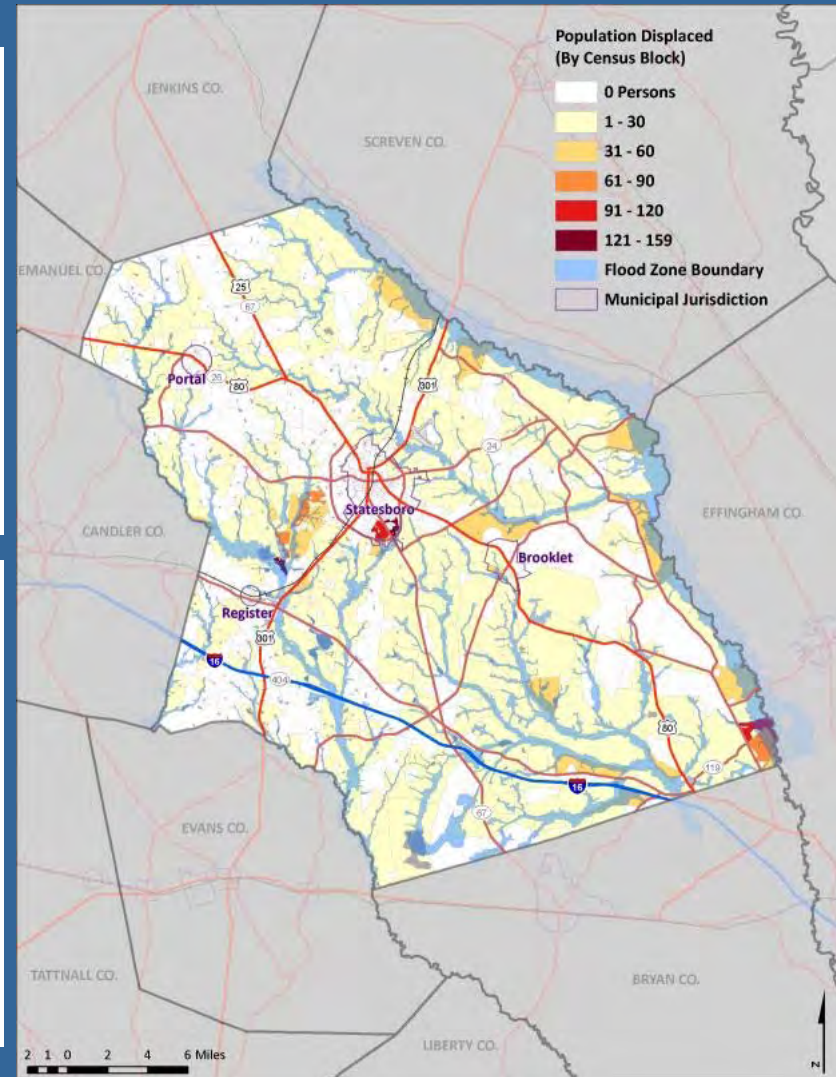
# Results: Social Vulnerability

## ESTIMATED SOCIAL IMPACTS (DFIRM)

County Pop.	Number of Households or Persons in Each Category		
	Households Displaced	Individual Persons Displaced	Individual Persons Seeking Shelter
55,983	1,379	4,138 (7%)	2,020 (4%)

## ESTIMATED SOCIAL IMPACTS (HAZUS)

County Pop.	Number of Households or Persons in Each Category		
	Households Displaced	Individual Persons Displaced	Individual Persons Seeking Shelter
55,983	1,110	3,330 (6%)	1,623 (3%)



DISPLACED POPULATION

\*Displaced households assumes the Georgia average of 3 persons per household





# Study Conclusions

- Mitigation Opportunities
  - 143 substantially damaged residential buildings
    - Acquire and demolish
    - Elevate
    - Relocate
    - Flood-proof or retrofit
- Agricultural Considerations
  - Crops are vulnerable; further study needed
- Social Vulnerability Concerns
  - 7% of pop. displaced
  - Further study needed to determine geography of at-risk population
  - Sheltering plans should be developed



# Traditional Risk Communication

- Prepared reports
- Community officials
- Public meetings
- News media



# Risk Communication

- Natural hazards are stressful
- Facilitate dialog and prioritize hazard knowledge
- Science + policy + **common sense**
- Reach all populations
- We have our work cut out for us...





# Risk Communication

- An **aware** public is an **empowered** public
- [georgiadfirm.com](http://georgiadfirm.com)



# Lessons Learned

- Appreciated the flexibility of UD depth grids
- Use CDMS, use CDMS, use CDMS
  - Update population data
  - Update essential facilities
  - Use local assessor's data where available
- Study additional results: vehicles, debris, indirect economic losses, etc.
- Recognized that **effective communication is the key**





# Questions? Thanks!

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